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Summary of 2006 Microturbine Applications Workshop

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Natural Resources Canada,
Ottawa, Canada

Turbo-Expo May 8-11 2006, Barcelona, Spain

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Background

- In January 2001 CANMET Energy Technology Center held a workshop on Microturbine Applications in Toronto, Canada. Debbie Haught of US DOE and Dave Stinton of ORNL participated.
- Each year the workshop has been held alternating between a US and a Canadian location.
- The workshop focuses only on microturbine technology and on sharing field demonstration experience.
- The directions to participants were to focus as much on things that went wrong as on things that went right so that new users might avoid common problems and to provide market feedback to the suppliers

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Acknowledgments

Putting on these workshops has been an interesting and rewarding joint US/Canada project with frequent contribution from European and Japanese companies.

I would like to acknowledge the tireless effort from Dave Stinton of ORNL who organized the US events including the 2006 Workshop in San Francisco and the support from Debbie Haught and the US DOE over the years

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MAW 2006 in San Francisco

- These presentations are available via US DOE's website or

www.microturbineapplicationsworkshop.ca

And you can also get all the presentations from previous workshops.

- Washington 2002
- Calgary 2003
- Los Angeles 2004
- Ottawa   2005

Microturbine Experience in the Gulf of Mexico

Stephen R. Frantz, P.E.

6th Annual Microturbine Applications Workshop

U.S. DOE/Canada NRC

January 18, 2006

Why a Microturbine Offshore?

- Electricity as a Necessary Evil
  - Oil Won't Flow w/o Power
  - Really Dark at Night w/o Power
  - Not in the Power Business
- What We Need
  - High Reliability - 99% vs. 95%
  - Small Footprint
  - Low Maintenance
- What We Like
  - High Efficiency
  - Low Emissions

BP Installation Overviews -

- Capstone Experience
  - GI-41A Offshore Platform
  - C60 unit, 55 site kW
  - High Pressure NG as fuel
  - Prime Power/Island Mode
  - No heat recovery

- Ingersoll-Rand Experience
  - Grand Isle Tank Battery
  - (2) MT250 units, 404 site kW
  - Low Pressure Flare Gas as fuel
  - Onboard Fuel Booster
  - Prime Power/Island Mode
  - No heat recovery

Package Performance

Grand Isle 41A

- Hours of operation to 12/31/05
  - Test Unit Ran for 6500 Hrs
  - Permanent Unit Ran for 25,000+ Hrs
- Availability
  - 99.9% Availability and Runtime for Both Units
- Current estimate of annual O&M costs excluding major hot end replacement
  - US$1000/yr and <$0.01/kWh
  - Only maintenance was air filter replacements, performed by BP field maintenance staff

Grand Isle Tank Battery

- Hours of operation to 12/31/05
  - Units Ran for 2825 & 2737 Hrs, respectively
- Availability
  - 73% for One Unit
  - 83% for Other
- Current estimate of annual O&M costs excluding major hot end replacement
  - US$4000/yr
  - $0.01/kWh

Conclusions - Lessons Learned/Future Opportunities

- Power is a Necessary Evil - So Keep It Simple
  - Simple Installation
  - Small Package Size and Weight
  - Low Maintenance
  - Consider Fired Hour Arrangements for Long Term
- Vendor Support Critical
  - Even though BP Knows Turbines, Still Need Specialized Help
  - BP Experience Should Be Incorporated into Future Designs
- R&D Possibilities
  - Continue to Increase Electrical Efficiency w/o Losing Reliability
- Look for GHG Opportunities - Vents, Flares

EPS microCHP field experience

EPS - EUROPEAN POWER SYSTEMS srl
Via Caltana 28, 35011 Campodarsego PD Italy
Phone +39-049-9202000 Fax +39-049-9202008
www.eps-energy.com info@eps-energy.com

Stefano Milani / General Manager
smilani@eps-energy.com

6th Annual Microturbine Applications Workshop
San Francisco, January 17-19, 2006

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Fitness Center

EPS PACKAGE 4 TA-100R
CHP TYPE Hot water
START UP May 2005
RUNNING HOURS About 1.100
FUEL Methane
LOCATION North-west Italy
NOTE New plant
Owner: gas utility
Outdoor installation in container

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Shopping Center

EPS PACKAGE 1 EPS-80R

CHP TYPE Hot water

START UP June 2004

RUNNING HOURS About 11.000

FUEL Methane

LOCATION North-west Italy

NOTE Heat district

Owner: ESCOs company

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Pacific Heights Towers Condominiums

20 Storey Condominium high rise
Load follows the electrical load of Building common area at 35 kW
Due to fast transfer building did not suffer any loss of power during Jan 1 power outage
Thermal energy goes to heat DHW
Recips would not be possible due to noise and vibration issues

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PureComfort 240 at UTM

Christopher Cheh
Director
Center for Emerging Energy Technologies

Presented at the 6th Annual Microturbine Applications Workshop

January 17-19, 2006

Hours of operation to December 31 2005

8028 Hrs

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AXIOM ENGINEERS

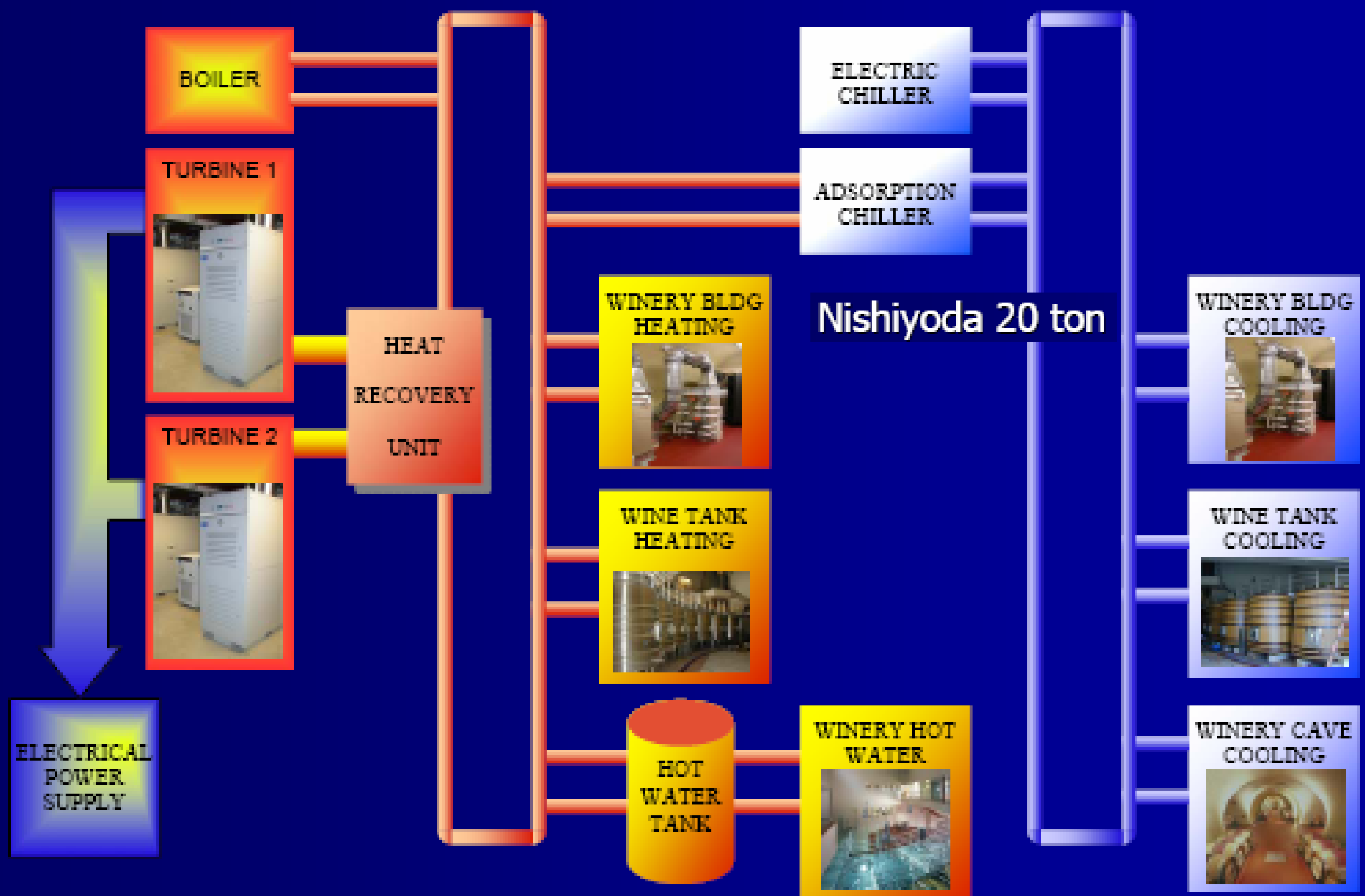
Capstone Microturbine CCHP at Vineyard 29, St. Helena, CA

The Good, the Bad and the Ugly

Chuck McMinn, Owner
Vineyard 29

Ray Cole, PE
Axiom Engineers

Backup Boiler for Water Heating when Turbines Offline
Backup Electric Chiller for Harvest Peak Cooling



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Performance

System Hours	Total: 19,000 T1: 14,150 T2: 13,686
Electrical Efficiency (LHV)	Utility: 21.5% Internal: 28.5%
Parasitic Loads	Full Load: 5KW Average: 2KW
Recovered Energy	8.4 Billion BTU to 12/31/2005 .44 Million BTU/hr.
Heat Exchanger	74 GPM 12° Delta T
CCHP Efficiency (HHV)	Utility: 64% Internal: 83%
Chiller COP	.65 BTU out/in

Axiom Engineers

Resulting in Overall Cost Savings and an Acceptable Payback

System Cost		$ 470,000
Less PGE Incentive ($1K/KW)		120,000
Less Avoided Costs	Backup Generator	120,000
	Larger Chiller	20,000
Net Cogen Capital Cost		210,000
Annual Energy Savings		25,000-38,000
Payback (years)		5.6-8.4 years*
*high end now due to gas cost spike		

AXIOM ENGINEERS

Cost Projections

Item	Actual#	100% Hindsight	50th Installation
Turbines	$150,000	$150,000	$100,000
HRU & Comp	$35,000	$35,000	$15,000
Chiller	$55,000	$55,000	$35,000
Mechanical#†	$105,000	$75,000	$35,000
Electrical*#	$135,000	$85,000	$50,000
Engineering	$30,000	$15,000	$10,000
Project Mgmt#†	$50,000	$25,000	$15,000
Commissioning#†	$50,000	$15,000	$5,000
Total	**$610,000**	**$455,000**	**$265,000**

Approximate because lumped into general Contract
* Includes Control and monitoring system
† Only partially billed to Vineyard 29

While the installation at Vineyard 29 has not been perfect, it has delivered on the design goals of:

- Lower power costs
- Increased power reliability
- Better environmental operation

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Conclusions

- The focus on getting actual users of microturbine installations to present has been useful
- The use of standar templates for cost and performance has enabled some tracking of installed cost components to be done
- Technology has matured
- Route to market seems to be through knowledgable deep pocket owners (eg BP) or motivated ESCO's

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